

CLAIMS

1. A device comprising:
a laminar body comprising:
a substrate having a first surface and a second surface;
at least one heating element disposed on the first surface; the heating element comprising:
a conductive layer patterned into at least two electrodes in a spaced relation to each other;
a resistive layer comprising a resistive material having a resistance that changes with temperature at a predetermined resistance temperature coefficient; the resistive layer being disposed to permit current to flow through the resistive material between the electrodes;
and
at least one fluid-receiving location corresponding to the location of the at least one heating element wherein the heating element is in thermal communication with the fluid-receiving location.
2. The device of claim 1 wherein the predetermined resistance temperature coefficient is positive such that the resistance increases with increasing temperature.
3. The device of claim 1 wherein the conductive and resistive layers are disposed by printing electrically-conductive and resistive inks.
4. The device of claim 1 wherein the at least one heating element is arranged in a concentric pattern.
5. The device of claim 1 wherein the laminar body further includes at least one heating element disposed on the second surface of the substrate; the heating element comprising:

a conductive layer patterned into at least two electrodes disposed in spaced relation to each other; and

a resistive layer comprising a resistive material having a resistance that changes with temperature at a predetermined resistance temperature coefficient; the resistive layer being disposed to permit current to flow through the resistive material between the electrodes.

6. The device of claim 1 further comprising
a bridge circuit; the bridge including the heating element and a plurality of other resistors; and

a control circuit for controlling a current in the bridge in such a manner that a predetermined temperature is maintained at the fluid-receiving location.

7. The device of claim 1 further including at least one geometry integrally formed in the laminar body at a location of the fluid-receiving location.

8. The device of claim 7 wherein at least one heating element is positioned along at least a portion of a surface of the geometry.

9. The device of claim 7 wherein at least one heating element is positioned at or above one or more predetermined volume graduation of the geometry.

10. The device of claim 7 wherein the geometry includes a reservoir or channel and the heating element is located adjacent to the reservoir or channel.

11. The device of claim 1 wherein further including a second body in thermal communication with the laminar body; the second body having at least one geometry configured to receive fluid and formed in the second body at a location corresponding to the fluid-receiving location of the laminar body.

12. The device of claim 11 wherein at least one heating element is positioned along at least a portion of a surface of the geometry.
13. The device of claim 11 wherein at least one heating element is positioned at or above one or more predetermined volume graduation of the geometry.
14. The device of claim 11 wherein the second body is a contact layer.
15. The device of claim 11 wherein the second body is a microfluidic device, a micro-centrifuge tube, or a micro-well plate.
16. The device of claim 11 wherein the laminar body and the second body are formed by a process to integrally marry the laminar body with the second body.
17. A method for concentrating and measuring microfluidic volumes comprising the steps of:
 - providing a laminar body comprising:
 - a substrate having a first surface and a second surface;
 - at least one heating element disposed on the first surface; the heating element comprising:
 - a conductive layer patterned into at least two electrodes in spaced relation to each other;
 - a resistive layer comprising a resistive material having a resistance that changes with temperature at a predetermined resistance temperature coefficient; the resistive layer being disposed between the electrodes to permit current to flow through the resistive material between the electrodes; and
 - at least one fluid-receiving location corresponding to the location of the at least one heating element wherein the heating element is in thermal communication with the fluid-receiving location;
 - placing a volume of fluid at the fluid-receiving location;

providing an electronics component having at least signal detection circuitry and control circuitry connected to the at least one heating element;
applying a voltage across the at least one heating element;
obtaining at least one electrical information from at least one of the heating elements; the electrical information being a function of the variable resistance of the resistive material;
monitoring the electrical information of the at least one heating element;
controlling the at least one heating element based on the electrical information calibrated to correspond to a known fluid volume or temperature; and
determining the fluid volume or temperature.

18. The method of claim 17 wherein the step of monitoring the electrical information includes monitoring the electrical information of one or more of the heating elements.

19. The method of claim 17 wherein the step of determining the volume of fluid includes calculating the fluid volume as a function of the resistance of the at least one heating element.

20. The method of claim 17 further including the step of:
positioning the at least one heating element along a surface of the fluid-receiving location at locations corresponding to known graduations of one or more fluid volumes;
determining the level of the fluid based on at least one electrical information of the at least one heating element.

21. The method of claim 17 further including the step of evaporating the fluid volume.

22. The method of claim 17 wherein the step of monitoring an electrical information includes monitoring the voltage or current across the at least one heating element.
23. A method for moving microfluids comprising the steps of:
providing a laminar body comprising:
a substrate having a first surface and a second surface;
at least one heating element disposed on the first surface; the heating element comprising:
a conductive layer patterned into at least two electrodes disposed in spaced relation to each other;
a resistive layer comprising a resistive material having a resistance that changes with temperature at a predetermined resistance temperature coefficient; the resistive material being disposed between the electrodes to permit current to flow through the resistive material between the electrodes; and
providing at least a first receiving location interconnected to a second receiving location; the heating element being located next to the first receiving location;
placing a volume of fluid in the second receiving location;
placing a volume of gaseous fluid in the first receiving location;
heating the volume of gaseous fluid to expand and exert pressure on the volume of fluid in the second receiving location to move the volume of fluid in the second receiving location; and
moving the volume of fluid.